

The image is a composite background. In the foreground, a sage-grouse is shown in profile, facing right. It has a large, white, ruffled collar around its neck, a dark head with a yellow patch above the eye, and brown and grey patterned feathers on its body. In the background, a cow with white and brown patches is standing in a field of dry grass and shrubs. The overall scene is a natural, arid landscape.

SAGE-GROUSE GRAZING EVALUATION STUDY

OBJECTIVES

- ❖ Measure & compare the vegetation response in pastures among different grazing treatments, relative to published sage-grouse habitat needs.
- ❖ Identify seasonal movements & habitat selection by sage-grouse hens & chicks to quantify use of different grazing treatments proportional to habitat availability and other drivers of sage-grouse resource selection.
- ❖ Measure individual vital rates known to impact population growth in sage-grouse & relate these estimated vital rates directly to habitat variables and other important drivers.

PVA

Make more birds

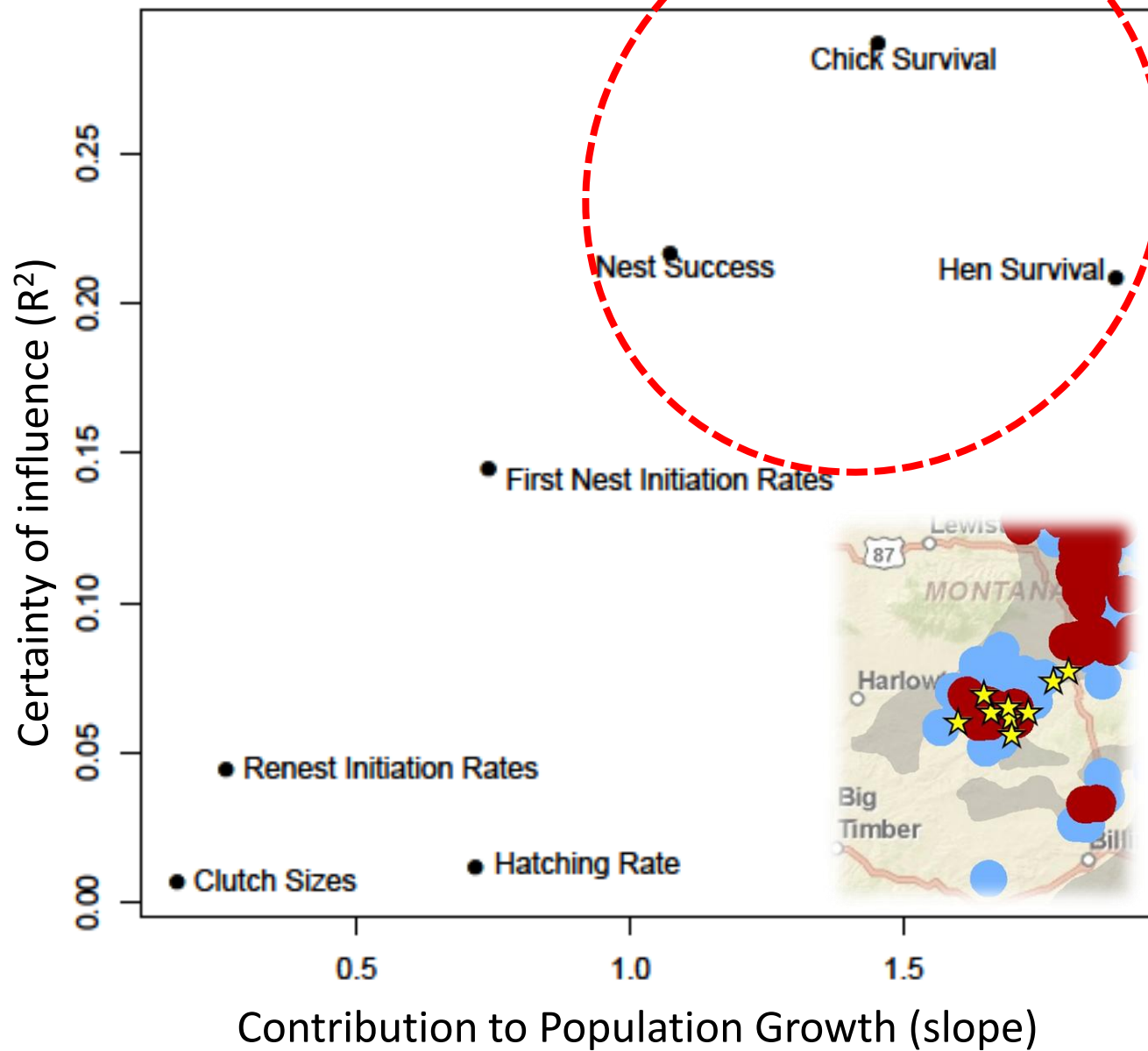


8% increase in
nest success



equates to 10% increase in
population growth

*Taylor, Naugle and Mills BLM Report
2011*





Population Ecology

Managing Multiple Vital Rates to Maximize Greater Sage-Grouse Population Growth

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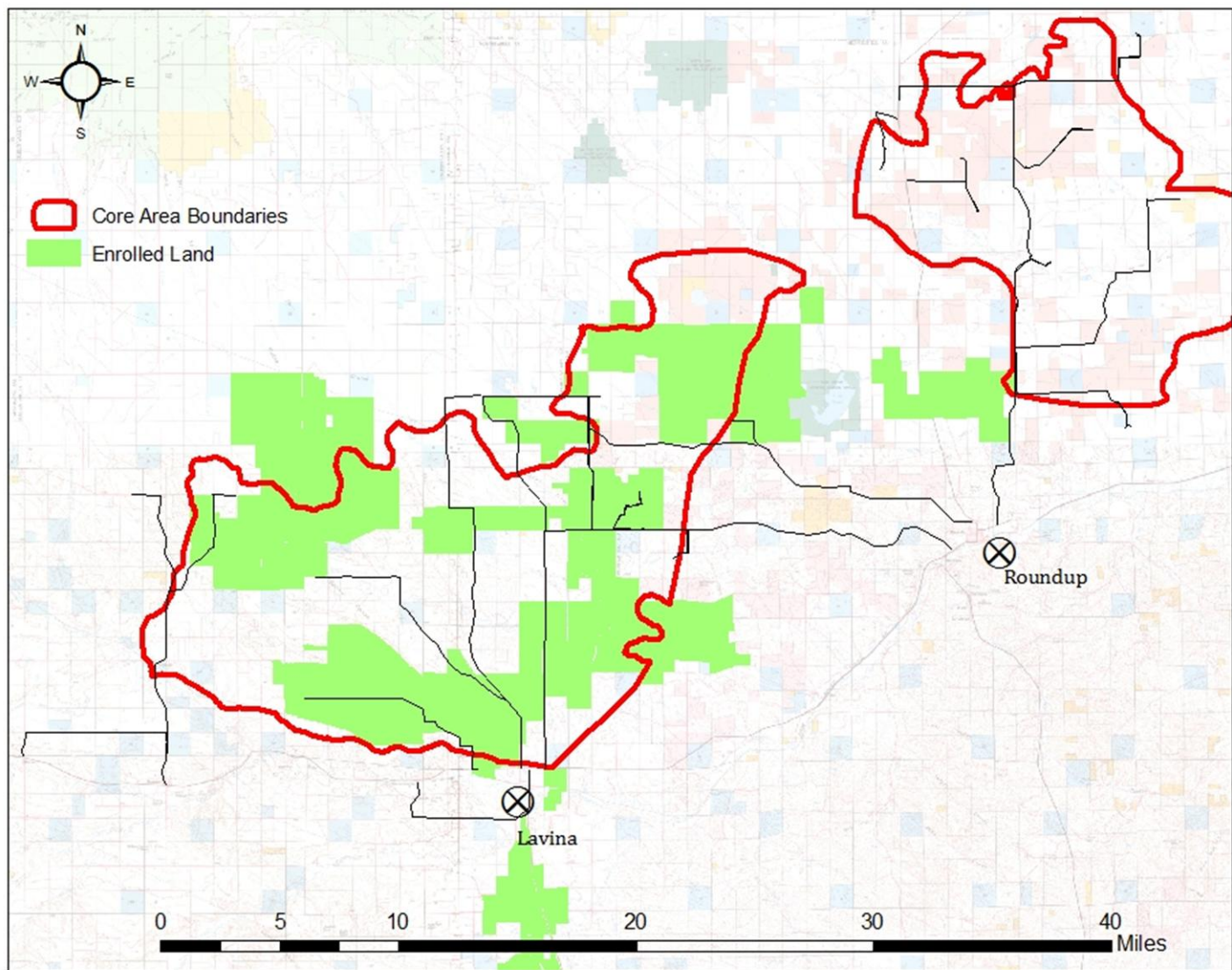


Photo by Joe Smith

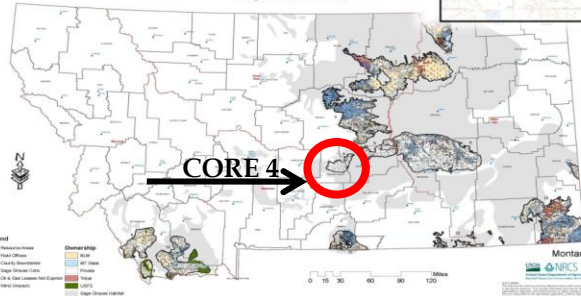


Photo by Conservation Media





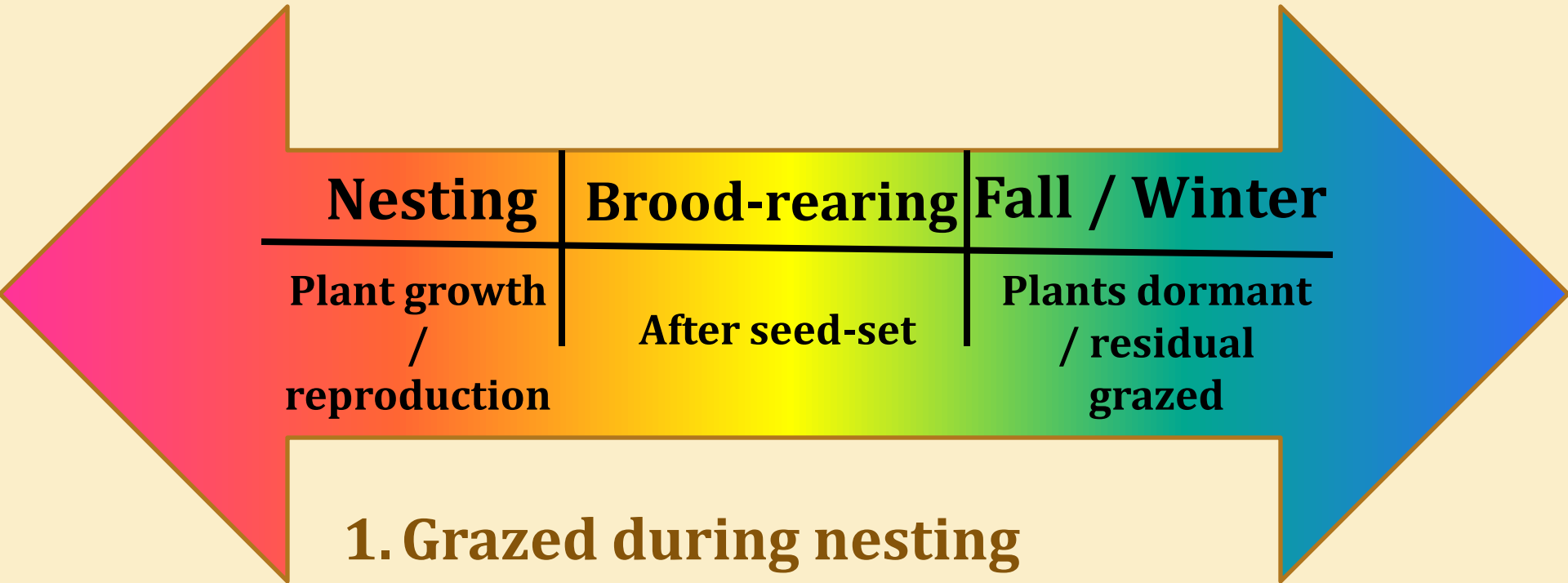
Sage Grouse Areas



STUDY AREA

Grazing Treatments

***Examine effects of timing of grazing*



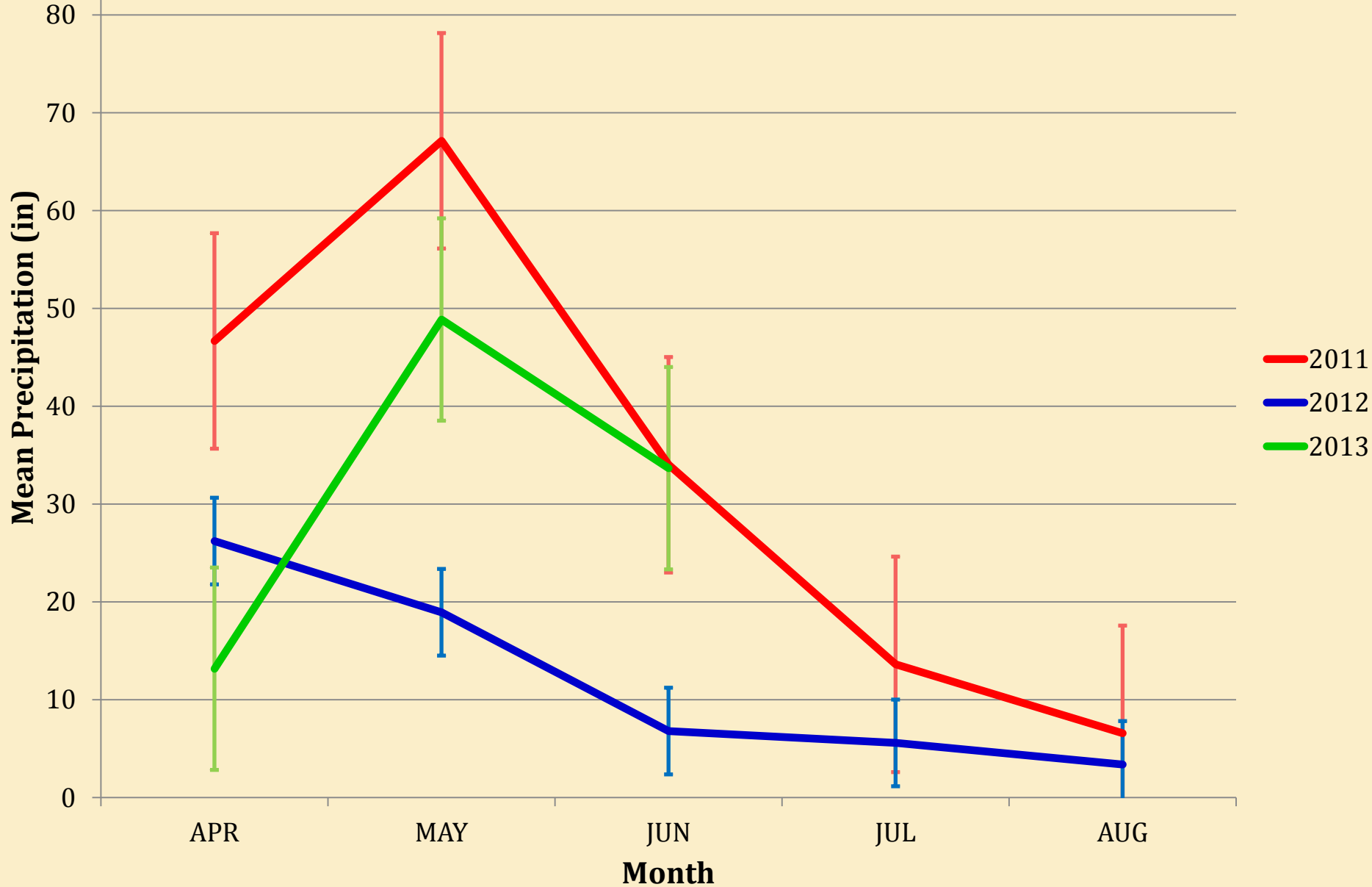
1. Grazed during nesting
2. Grazed during brood-rearing
3. Grazed during fall / winter
4. No grazing

| Treatment & Rest History Combinations | | | | | | | | |
|---------------------------------------|------------------|---|----|----|---------------|---|----|----|
| | Year <i>t</i> -1 | | | | Year <i>t</i> | | | |
| | N | B | FW | NO | N | B | FW | NO |
| 1 | x | | | | x | | | |
| 2 | | x | | | x | | | |
| 3 | | | x | | x | | | |
| 4 | | | | x | x | | | |
| 5 | x | | | | | x | | |
| 6 | | x | | | | x | | |
| 7 | | | x | | | x | | |
| 8 | | | | x | | x | | |
| 9 | x | | | | | | x | |
| 10 | | x | | | | | x | |
| 11 | | | x | | | | x | |
| 12 | | | | x | | | x | |
| 13 | x | | | | | | | x |
| 14 | | x | | | | | | x |
| 15 | | | x | | | | | x |
| 16 | | | | x | | | | x |
| 17 | x | x | x | | x | x | x | |

N = Nesting
 B = Brood-rearing
 FW = Fall /
 Winter
 NO = no grazing

***Treatment
 combination 17
 = grazed during
 multiple
 treatments each
 year*

Total Precipitation per Month - Mean of all Weather Stations in Golden Valley & Musselshell Counties

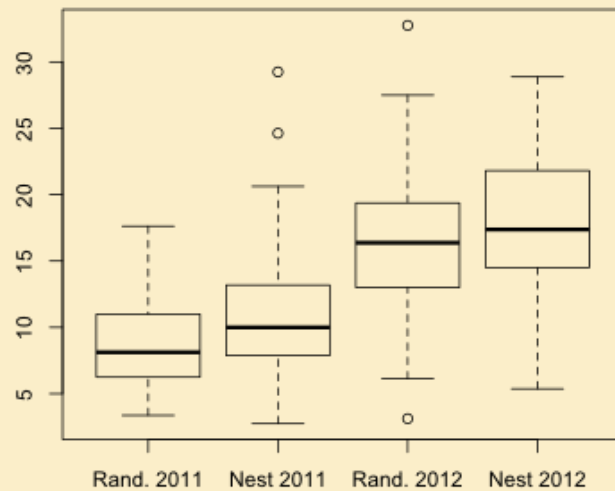


Preliminary analysis

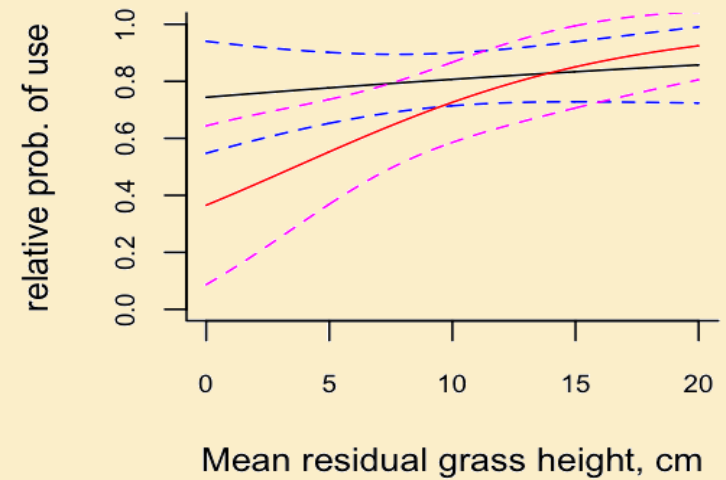
Selection for herbaceous cover depends on availability?

Annual variation

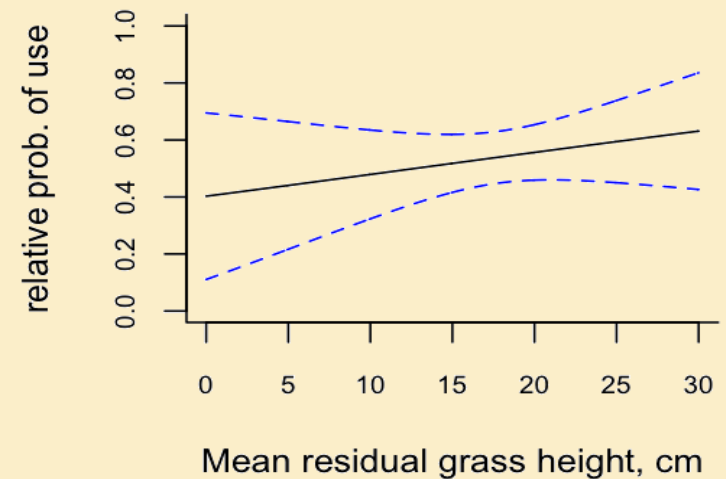
Residual Grass Height at Random and Nest plots



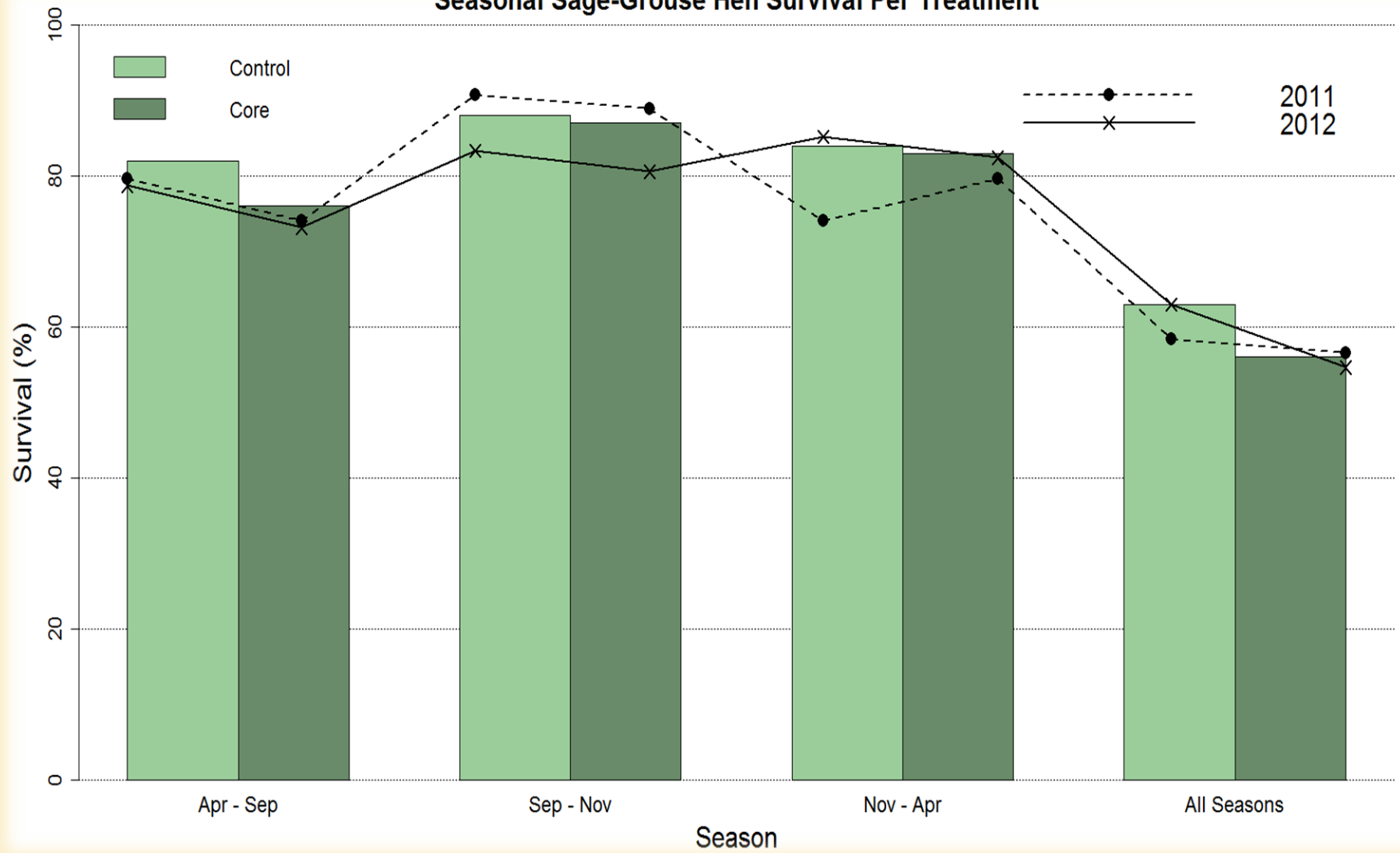
2011



2012



Seasonal Sage-Grouse Hen Survival Per Treatment



HEN SURVIVAL

- ❖ 37-78% across range
 - ❖ 48-78% = Wyoming
 - ❖ 48-75% = Idaho
 - ❖ 57% = Alberta, Canada
 - ❖ 61% = Colorado
 - ❖ 37% = Utah

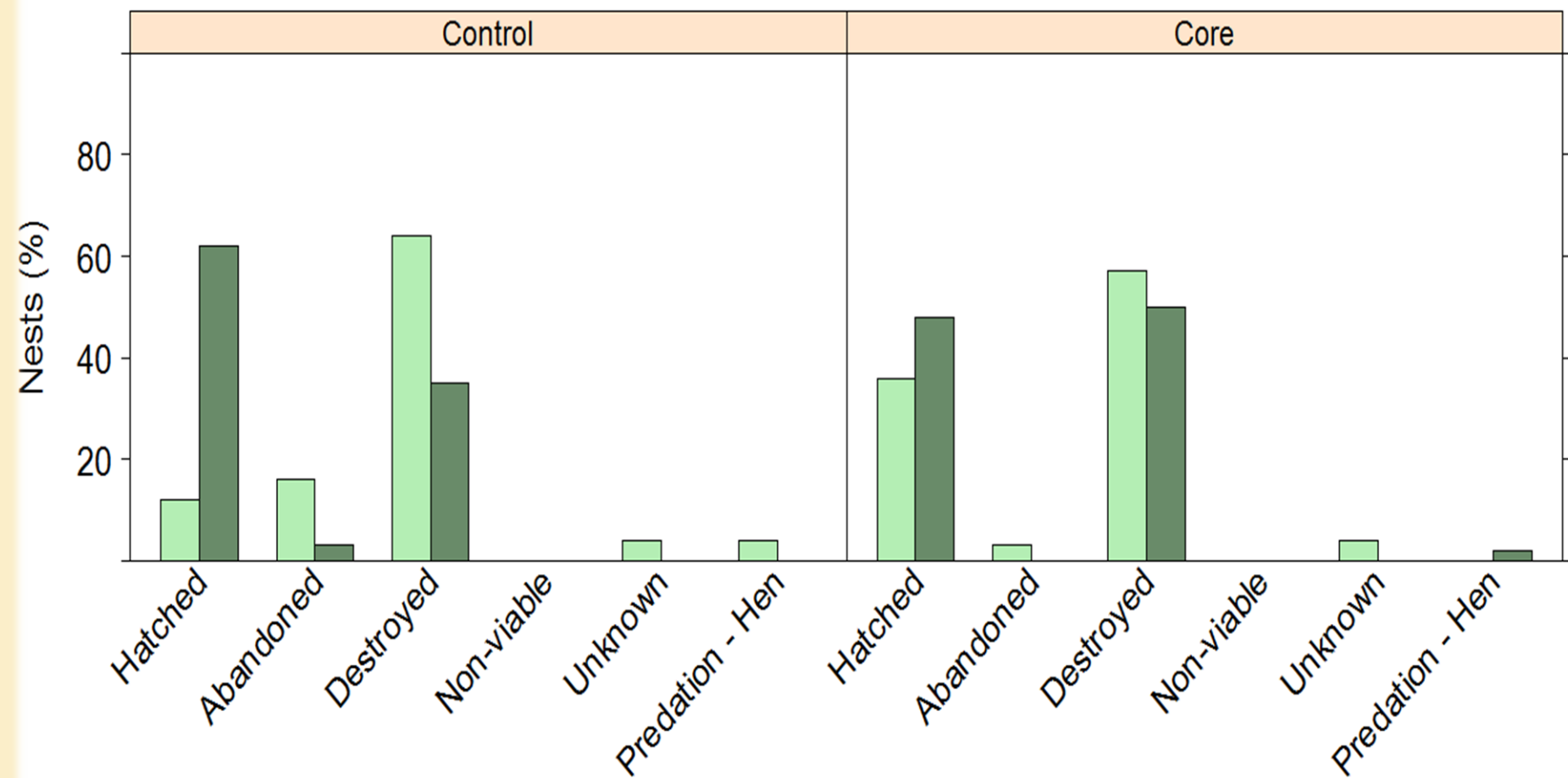
This study = 59% (2011-12, all seasons)

SEASONAL HEN SURVIVAL

- ❖ Apr – Sep (Spring / Summer) = 55-99%
 - ❖ Nesting & brood-rearing
- ❖ Sep – Nov (Fall) = 84-94% (1 study)
 - ❖ Broods break-up; juveniles become independent
- ❖ Nov – Apr (Winter) = 82-100%
- ❖ Our study:
 - ❖ Spring / summer = 79%
 - ❖ Fall = 89%
 - ❖ Winter = 83%

Nest Fates by Year and Treatment

2011 2012



NEST SUCCESS

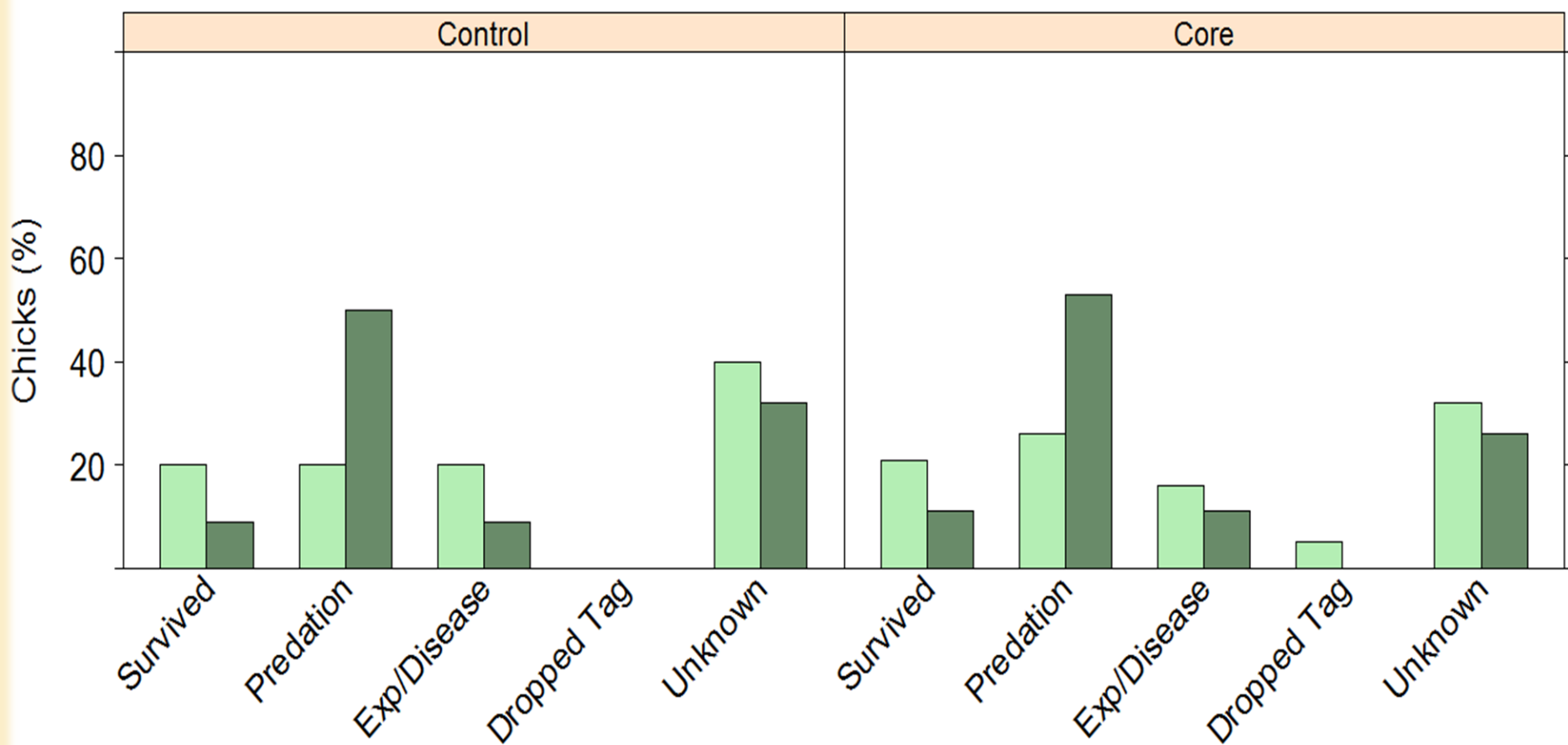
- ❖ 14.5 - 86.1% across range
 - ❖ 46% = mean nest success / 29 telemetry studies

This study = 59% (2011-12, all seasons)

**Nest success = at least 1 egg hatches

Chick Fates by Year and Treatment

2011 2012

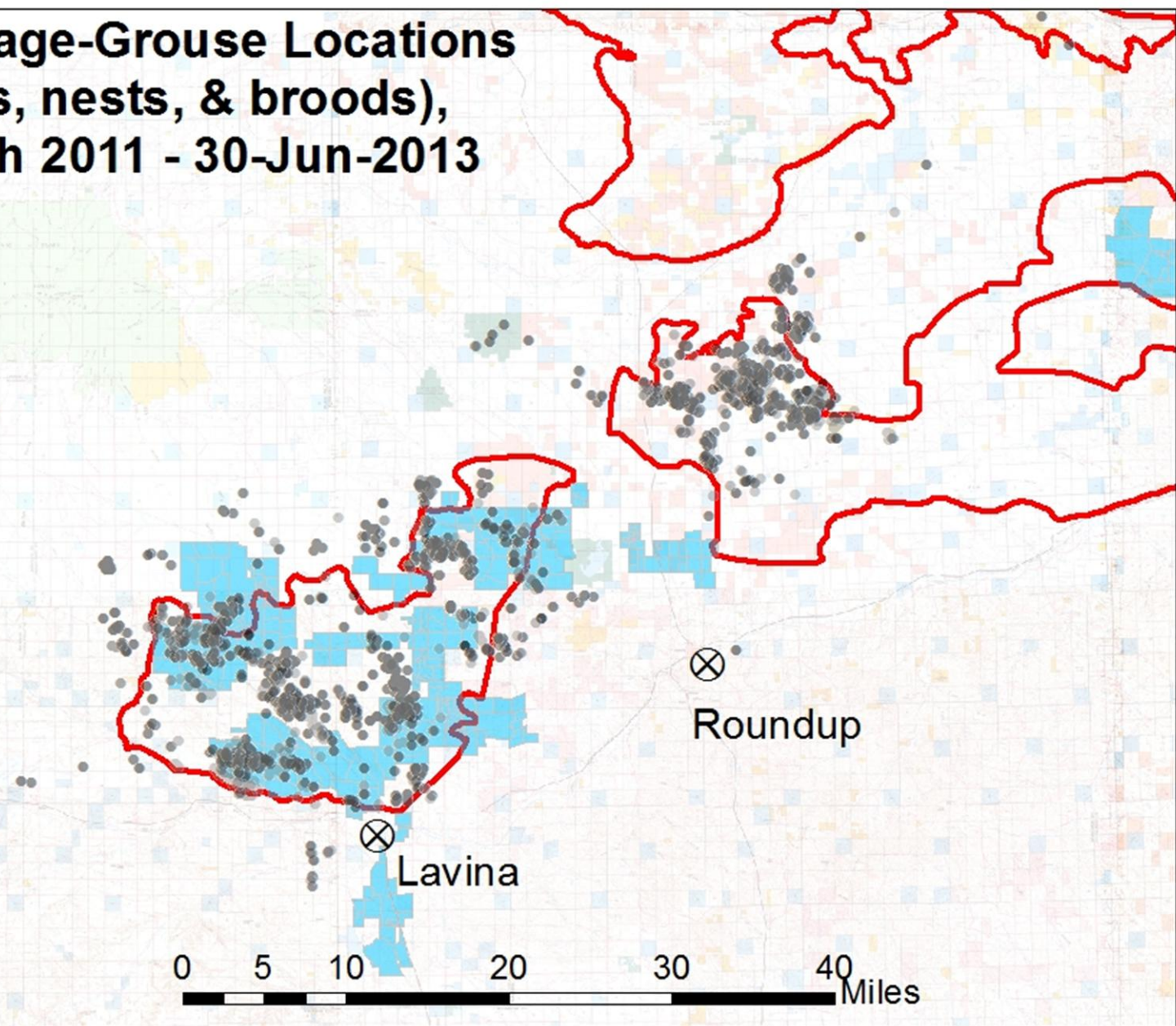


CHICK SURVIVAL

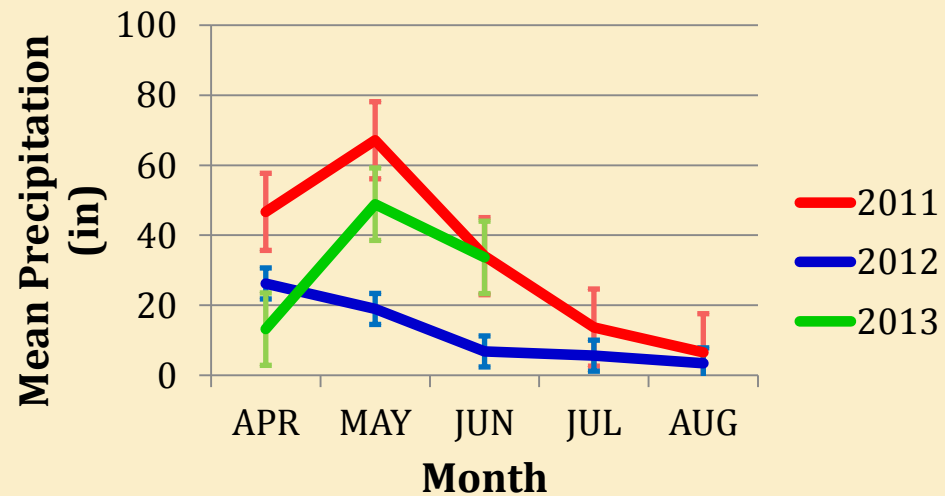
❖ 12-50% across range, 1st 3 wks post-hatch

This study = 12% (2011-12)

**All Sage-Grouse Locations
(hens, nests, & broods),
March 2011 - 30-Jun-2013**

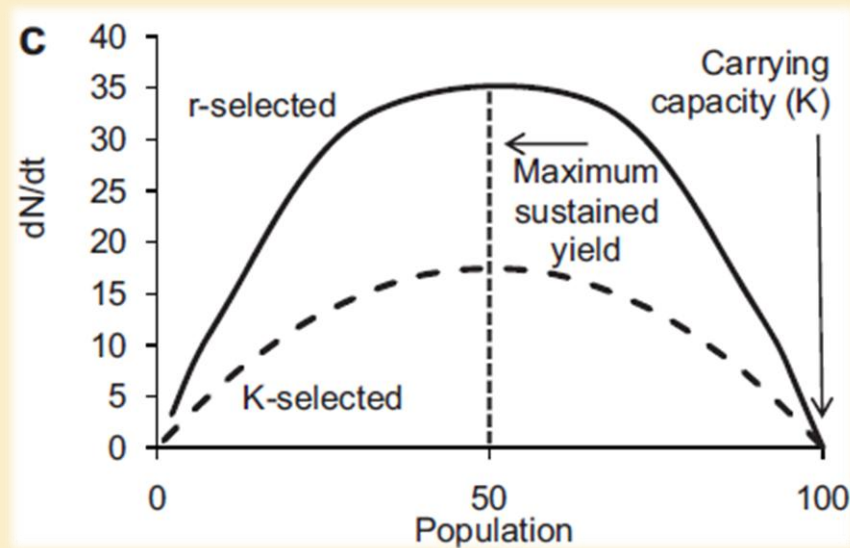
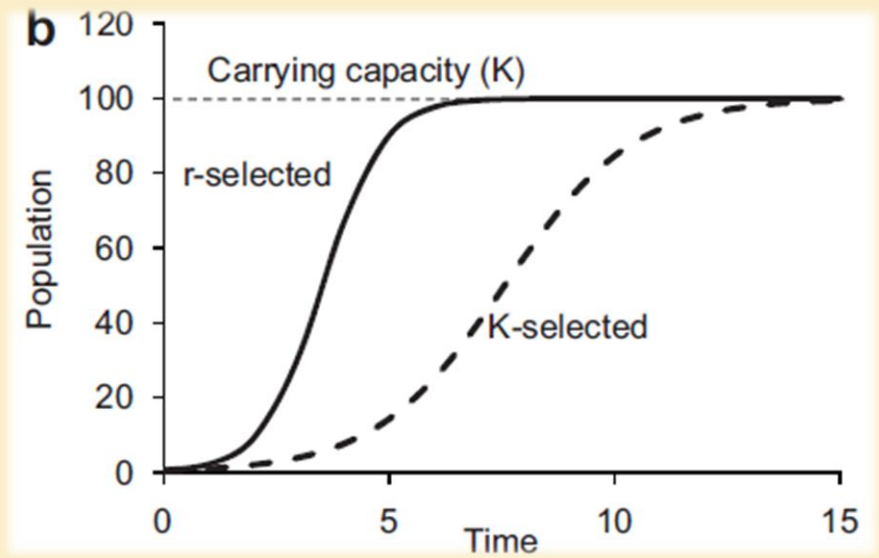
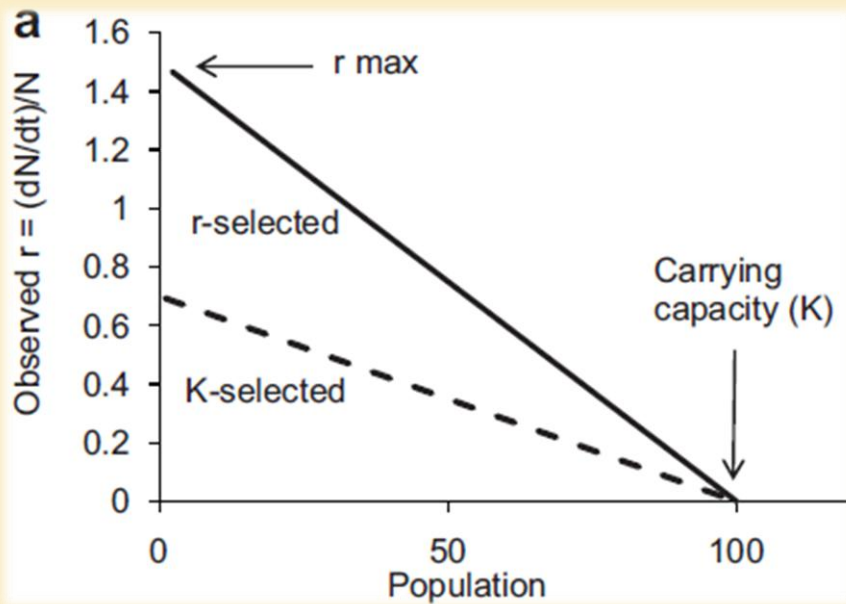


Long-term Study



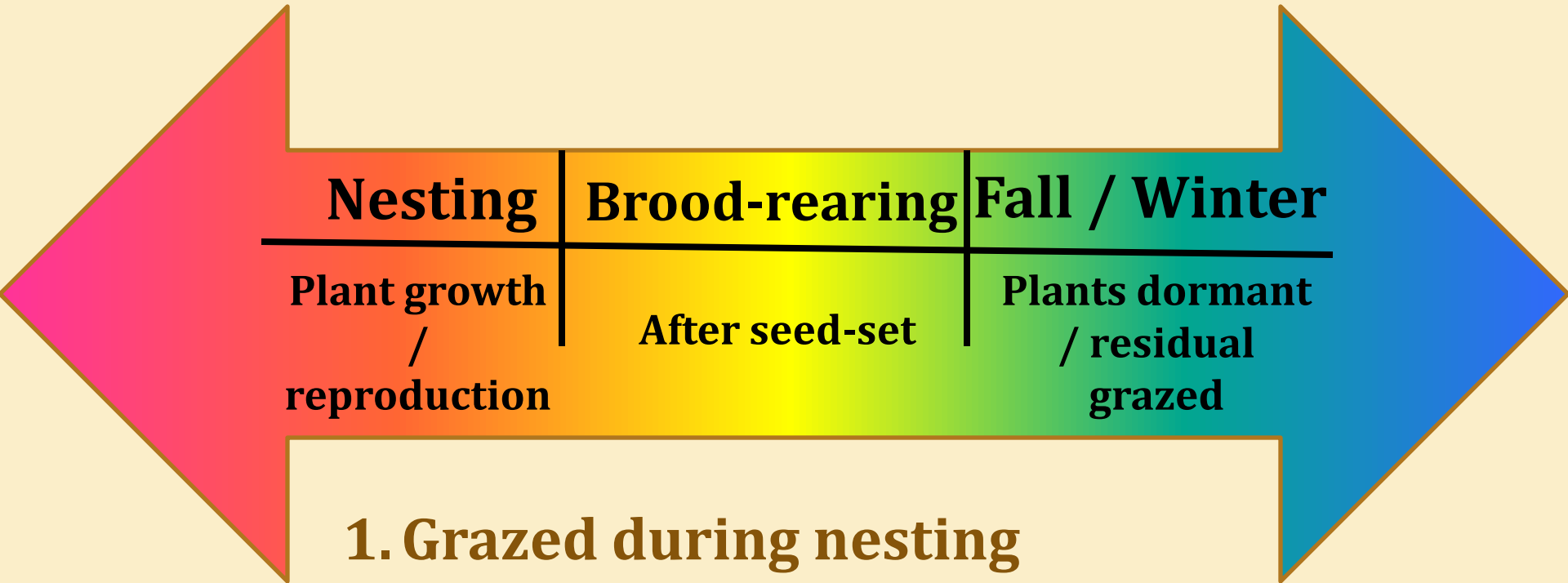
LAG OF SAGE-GROUSE POPULATION RESPONSE TO MANAGEMENT

- ❖ Vegetation does not respond immediately to management changes
- ❖ Yearling males and females may not breed in their 1st year
- ❖ Sage-grouse populations may be cyclic (e.g., 10-yr cycle in many wildlife species); short-term management will not be detected right away
- ❖ Lack of knowledge of important population drivers (e.g., juvenile survival) that we are currently measuring



Grazing Treatments

***Examine effects of timing of grazing*



1. Grazed during nesting
2. Grazed during brood-rearing
3. Grazed during fall / winter
4. No grazing
5. Grazed during multiple treatments

PREDICTIONS - VEGETATION

- Positive effects of grazing on vegetation:
 - ++ Any 2 yr grazing combination that includes at least a year of rest
 - + 2-yr grazing combinations where timing of grazing is changed (e.g., trmt 1 followed by trmt 2)
- Negative effects of grazing on vegetation:
 - -- grazing during nesting in both years (before seed-ripe)
 - - grazing during brood-rearing each year
 - -- grazing spanning multiple treatments each year

*** “++” is very positive; + is positive; “ -- ” is very negative; “-” is negative*

PREDICTIONS – HEN SURVIVAL

- Positive effects of grazing on hen survival:
 - ++ Any 2-yr grazing combination that includes at least a year of rest (trmt 4)
 - + Any 2-yr grazing combination that changes timing of grazing
- Negative effects of grazing on hen survival:
 - -- Grazed during nesting each year
 - -- Grazed during multiple treatments each year
 - - Grazed during fall / winter both years

*** “++” is very positive; + is positive; “--” is very negative; “-” is negative*

PREDICTIONS – NEST SUCCESS

- ❖ Positive effects of grazing on nest success:
 - ❖ ++ Any 2-yr grazing combination that includes at least a year of rest
 - ❖ + Any 2-yr grazing combination that does not graze during nesting, brood-rearing, or fall / winter treatments in consecutive years
- ❖ Negative effects of grazing on nest success:
 - ❖ -- Grazed during nesting during consecutive years
 - ❖ -- Grazed during multiple treatments each year
 - ❖ - Grazed during fall / winter or brood-rearing treatments during consecutive years

*** “++” is very positive; + is positive; “--” is very negative; “-” is negative*

PREDICTIONS – CHICK SURVIVAL

- Positive effects of grazing on chick survival:
 - ++ Any 2-yr grazing combination that includes at least a year of rest
 - + Any 2-yr grazing combination that does not graze during nesting, brood-rearing, or fall / winter treatments in consecutive years
- Negative effects of grazing on chick survival:
 - -- Grazed during nesting during consecutive years
 - -- Grazed during multiple treatments each year
 - - Grazed during fall / winter or brood-rearing treatments during consecutive years

*** “++” is very positive; + is positive; “--” is very negative; “-” is negative*

COLLABORATIVE STUDIES

Food Availability for Sage-Grouse

- ❖ Response of arthropod diversity, abundance & availability to grazing



How does conservation of sagebrush ecosystems impact other bird species?

- ❖ Response of sagebrush, shrub, & grassland birds to grazing



FUNDING

- ❖ Conservation Innovation Grant – USDA Natural Resources Conservation Service
- ❖ Federal Aid in Wildlife Restoration (Pittman-Robertson) grants - Montana Fish, Wildlife, and Parks (FWP)
- ❖ US Fish and Wildlife Service, Pheasants Forever, Intermountain West Joint Venture cooperative grant
- ❖ Sales of hunting and fishing licenses in Montana
- ❖ Upland Game Bird Enhancement program - FWP
- ❖ Big Sky Upland Bird Association

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SAGEBRUSH, SHRUB, & GRASSLAND BIRDS OF CONSERVATION CONCERN

Lark Sparrow



Brewer's Sparrow



Grasshopper Sp.



Vesper Sparrow



W. Meadowlark



Loggerhead Shrike



Savannah Sparrow



Lark Bunting



Sage Thrasher



PREDATORS OF SAGE-GROUSE

- ❖ Red fox (*Vulpes vulpes*)
- ❖ Coyote (*Canis latrans*)
- ❖ American badger (*Taxidea taxus*)
- ❖ Bobcat (*Lynx rufus*)
- ❖ Domestic cat
- ❖ Weasels (*Mustelidea* family)
- ❖ Common Raven (*Corvus corax*)
- ❖ A variety of raptor species

PREDATION & SAGE-GROUSE

Predation = main source of mortality in most sage-grouse studies across its range..... HOWEVER,

“.....rates [nest] of predation are tied to habitat quality, and it has been suggested that the most efficient method for mitigating high rates of nest predation may be through the effective management of habitat.”

PREDATION & SAGE-GROUSE

“Nest predation is a natural component of greater sage-grouse reproduction, but changes in nesting habitat and predator communities may adversely affect grouse populations.”

Coates & Delehanty 2010. Journal of Wildlife Management 74:240-248.

EFFECTS OF PREDATION ON SAGE-GROUSE

| Study | Vital Rate | Location | Predation Rate (%) | Success Rate (%; hatch or survival) |
|-------------------------|-----------------------------------|----------------|--------------------|-------------------------------------|
| Coates & Delehanty 2010 | Nest Success | Nevada | 42.5 | 50.6 |
| Walker 2008 | Nest Success | Montana | 34 | 49 |
| Walker 2008 | Nest Success | Wyoming | 23 | 71 |
| Walker 2008 | Nest Success | Wyoming | 43 | 43 |
| Beck et al. 2006 | Juvenile Survival (10-40 wks old) | Idaho | 63 | 86, 64 (2 popn's) |
| Gregg & Crawford 2009 | Chick Survival (hatch - 28 d) | Nevada, Oregon | 81 | 39 |
| Dahlgren et al. 2010 | Chick Survival (hatch – 42 d) | Utah | 32 | |
| | | | | |
| | | | | |
| | | | | |

Figure 1. MacArthur (1972) population model of proposed r - and K -selection where (a) the second derivative rate of population growth as a function of increasing density $[(dN/dt)N]$ where the y intercept represents r_{\max} , the maximum biological growth potential or exponential growth, which is greater for r -selected species, (b) r -selected species will grow faster toward a carrying capacity (K), and (c) the change in the population over time (dN/dt) occurs in a symmetric parabolic shape (with the peak occurring at $K/2$, maximum sustained yield in harvest dynamics, and approaching zero when the population reaches carrying capacity) where r -selected species produce a larger parabolic shape.

| Treatment & Rest History Combinations | | | | | | | | |
|---------------------------------------|------------------|---|----|----|---------------|---|----|----|
| | Year <i>t</i> -1 | | | | Year <i>t</i> | | | |
| | N | B | FW | NO | N | B | FW | NO |
| 1 | x | | | | x | | | |
| 2 | | x | | | x | | | |
| 3 | | | x | | x | | | |
| 4 | | | | x | x | | | |
| 5 | x | | | | | x | | |
| 6 | | x | | | | x | | |
| 7 | | | x | | | x | | |
| 8 | | | | x | | x | | |
| 9 | x | | | | | | x | |
| 10 | | x | | | | | x | |
| 11 | | | x | | | | x | |
| 12 | | | | x | | | x | |
| 13 | x | | | | | | | x |
| 14 | | x | | | | | | x |
| 15 | | | x | | | | | x |
| 16 | | | | x | | | | x |
| 17 | x | x | x | | x | x | x | |

N = Nesting
 B = Brood-rearing
 FW = Fall /
 Winter
 NO = no grazing

Red = negative

Yellow = positive

***Treatment
 combination 17
 = grazed during
 multiple
 treatments each
 year*